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ABSTRACT

This paper reports some of the results of the "Raising Standards in Numeracy" project which was funded by the Welsh Assembly during the period 1999/2000. Schools in which pupils achieved standards significantly higher than would have been expected from their prior attainment were identified using value-added analyses in order to explore factors and strategies which might contribute positively towards standards in mathematics. Two primary and two secondary schools were identified in each of five LEAs. Management strategies and processes which might contribute to high attainment were then explored through extended interviews with LEA advisors, head teachers and mathematics subject leaders. These factors were triangulated through extended interviews with classroom teachers and through participant observation in the classroom. This paper focuses on aspects of effective middle management. (Contains 19 references.) (Author/MM)

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The role of middle managers in raising standards in mathematics

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Abstract

This paper reports some of the results of the "Raising Standards in Numeracy" project which was funded by the Welsh Assembly during the period 1999/2000. Schools in which pupils achieved standards significantly higher than would have been expected from their prior attainment were identified using value-added analyses in order to explore factors and strategies which might contribute positively towards standards in mathematics. Two primary and two secondary schools were identified in each of five LEAs. Management strategies and processes which might contribute to high attainment were then explored through extended interviews with LEA advisors, head teachers and mathematics subject leaders. These factors were triangulated through extended interviews with classroom teachers and through participant observation in the classroom. This paper focuses on aspects of effective middle management.

Introduction

This paper describes some of the results of one strand of a collaborative project □Setting Targets to Raise Standards□. The project was funded by the Welsh Assembly, led by the Vale of Glamorgan and involves 5 Welsh LEAs and the University of Wales Swansea. The project was built around earlier work by the Vale of Glamorgan involving the development of value-added analyses linking National Curriculum data to prior attainment scores, and the development of an approach to target setting based on pupil level data. The project was multi-faceted and included strands, which are not reported on here, relating to the development and validation of pupil centered approaches to target setting and the impact of differing forms of data analysis and presentation. This paper reports on the strand of the project entitled □Improving Standards in Numeracy□ which drew together evidence from 20 particularly successful schools in the 5 LEAs to identify factors and strategies which appeared to contribute positively towards standards in numeracy and mathematics. This paper focusses on the practices of middle management.

Aims

The research design was a simple one. In each of the 5 LEAs, we intended to identify 2 primary schools

and 2 secondary schools which were particularly successful in developing the mathematical abilities of their pupils. Value-added analyses and estimates of pupils' potential attainment were to be used to identify those schools where pupils obtained significantly higher than expected scores in statutory tests. In fact, the selection of schools was slightly more complicated than anticipated and value-added data was supplemented with other longitudinal data. (Fuller details are given in the tables below.) These schools were then visited by the researchers, who interviewed head teachers, subject leaders and teachers in order to allow them to explain the reasons for their success and to identify and to investigate factors contributing to the effective teaching of numeracy. Lessons were observed to examine the classroom processes in practice. Common factors of good practice were then identified. This paper identifies the common features we found at the level of classroom practice.

School effectiveness and value added

A considerable body of research now exists to counter the claim that schools have uniform effect, indicating instead that individual schools can exert an influence above and beyond the qualities of their incoming pupils, their families and even the social determinants of gender, class and race (Mortimore et al, 1994, p316). Twenty years ago *Fifteen Thousand Hours* (Rutter et al, 1979) used verbal reasoning data as a baseline measure against which to measure examination results and came to the conclusion that schools made a difference. However, as Nuttall (1990, p25) suggested, □natural justice demands that schools are held accountable only for those things they can influence□. League tables based on raw assessment data are □rarely worth the paper they are printed on□ in relation to the insights they provide as they say more about intake than school effectiveness (Murphy, 1997, p33). Value-added methods, based on the progress pupils make rather than raw assessments should be used to evaluate the differential effectiveness of schools (Mortimore et al, 1994; Nuttall, 1990; Saunders, 1999).

Analyses which focus on the progress made by pupils between their time of entry and their time of leaving are properly called □value-added□. The term is not well defined, however, and is sometimes used for measures based solely on attainment across a phase or key stage using the same scale at both ends, for example national curriculum levels, but often the baseline data which is controlled for in the analysis uses a different scale, for example a standardized test or simply a test which experience shows to be a good predictor of output scores in examinations, such as Yellis for example. Value-added is also used for analyses controlling not only for prior attainment but also other factors related to attainment such as socioeconomic status. Occasionally it is misused (in our opinion) to describe analyses which control only for factors other than prior attainment eg: free school meals, which would be better described as contextualisation than value added (Schagen, 1998, p2). In general the term is used to represent a fairer way of measuring pupils□ performance, stripping away those factors which are associated with attainment but are not related to institutional quality (Saunders, 1999) and that is the definition used here as being most appropriate for our purposes.

Although Fitz-Gibbon (1994, p11) warns against the use of socio-economic data when compiling value-added rankings as □they look like an excuse for expecting little from the poor□, experience suggests that such factors make a small but significant contribution. However, league tables of schools, even if based on value-added data, are □statistically pretty worthless□ with most schools indistinguishable from each other within the 95% confidence interval (Shagen, 1998, p4). For the purposes of this study, however, we do not require stable league tables which can distinguish between all schools. What we require is an analysis which can identify the minority of institutions which are achieving significantly more than would be expected given the prior attainment of their pupils and their context, thus identifying a small number of schools where we might expect to find institutional factors which might be described as □ good practice□. Good practice in this sense would be defined as those practices which are common to

schools which are successful in examinations when non-institutional factors related to attainment are stripped away through the use of value-added analyses.

The intention of this research was to determine the nature of those institutional factors rather than to consider whether the educational experiences of pupils in those schools measured up against some pre-existing notion of what □good practice□ might be. Clearly the researchers did have pre-existing notions as to the nature of good practice and their observations were necessarily coloured by the lens of their previous experiences as teachers, teacher trainers and researchers. However, we tried at all times to maintain a degree of reflexivity in our observations and to be aware of our own prejudices during observation and interview. Wherever possible, respondent and observer triangulation was used to confirm results which were then subjected to respondent validation.

A further note of caution should be added here in relation to the hidden assumptions in the methodology. Success is being judged here in terms of external examination results in mathematics. This target should not be accepted uncritically, as there are greater goals for education than the passing of examinations. For example, improved value-added scores in mathematics might be achieved by increasing the proportion of curriculum time and resources allocated to it or raising its status above, say, Art, History or Religion. This might be unacceptable in terms of other goals held for education. The analysis represents one instrument of evaluation amongst many - not everything which is desirable in education is measurable and vice-versa. However, success in mathematics examinations is one significant goal for education and the results should be read in that context.

□The numbers which emerge from any kind of analysis should not be regarded as absolute truth□. They are the result of fitting a mathematical model to pupil data and are subject to errors (Shagen, 1998, p3). They are only as good as the data on which they are based, so for example, an artificially low baseline score due to poor practice prior to a KS1 assessment might lead to an artificially high score in value-added terms at KS2. The results are based on correlations and not causes and deal with a retrospective, normative model which assumes relationships and processes are sufficiently stable over periods of 2, 3 or 4 years to allow conclusions to be drawn. During a time of continuous educational change extrapolation may be problematic (Shagen, 1998; Saunders, 1999).

In fact, analysis of Vale of Glamorgan data indicates that, in the case of mathematics in particular, National Curriculum data when evaluated against NFER (mathematics) standardized test data has been remarkably consistent and the analyses which follow are based on data which is sufficiently stable to allow conclusions to be drawn. Significant changes in *practice* had occurred in some of the individual schools considered, however, and in fact these very changes may have contributed to the high achievement noted. Statistical data therefore, was complemented by advice from LEA advisors for the selection of schools.

Research on effective schools suggests a number of factors associated with high attainment, however,

> it is more difficult to discover how such schools came to their current state and even more difficult to increase the effectiveness of other schools... most variation in performance... is actually explained by differences between classes rather than schools. The suggestion is that it is teachers not schools that make the difference
>
> (Ayers et al, 1999, p1).

Our value added analysis was at the level of school rather than individual teacher and we were not

comparing teachers with each other but were identifying common features of good practice over a number of institutions and contexts over a number of years. Thus the task of the researchers was to determine not what was happening now, but probe for what had been happening during the previous appropriate key stage at the level of school, subject and teacher. A significant proportion of our data was collected in classrooms with individual teachers looking for common features across contexts.

Methodology

The aim of selecting schools was to identify those where pupils' progress in mathematics, as measured by National Curriculum Tests or GCSE results, was significantly more than in schools generally. One strand of our project was to test and validate models which use prior attainment data to estimate the likely performance of individual pupils at end of each key stage.

The models, developed initially as part of a pupil-based approach to value-added and target-setting within the Vale of Glamorgan, use non-linear regression techniques to estimate the probability that pupils will achieve at or above a given level at the end of each key stage. Overall, the current models estimate attainment at individual pupil level to an accuracy of 85%, i.e. of the pupils estimated to achieve level 4 or above at Key Stage 2 (using Key Stage 1 data) around 85% achieve level 4 or level 5.

Once individual pupil estimates had been calculated, a whole-school estimate (the mean of each individual pupil's estimate) was then compared with actual results. Taking into account the standard deviation of the prediction and the number of pupils involved, it was possible to identify schools where achievement was significantly higher than predicted.

Following discussions with LEA advisors, 2 secondary schools and 2 primary schools were selected from those schools in each LEA which showed the highest added-value. Matched cohort data did not yet exist for KS1 to KS2. However, 3 years of KS1 data (95/96 to 97/98) and 3 years of KS2 data 95/96 to 97/98) did exist so estimates averaged across 3 years of KS 1 data were used to provide a reasonable basis for comparison.

As can be seen from the data in Table 1, a full sample in which the difference was significant at the 5% level could not be generated in this manner and an alternative criterion based on improvement over the three year period was used to complete the sample.

The value-added selection: primary schools

Schools were selected on the basis of two criteria:

A. Attainment in mathematics at level 4+ (averaged over the three years for which data is available) is significantly higher (<5%) than the estimate (in either all 3 years or in the last 2 years) provided by analysing Key Stage 1 data.

B. Attainment at Key Stage 2 has shown an improvement over the three year period with attainment in 97/98 being higher than the estimate from Key Stage 1 data.

Four schools were identified within each LEA of which two were selected following discussion with each LEA contact. Data for the schools selected is shown below:

Table 1: The selection criteria for the primary schools

School	A	B	KS1 Est	KS2 95/96	KS2 96/97	KS2 97/98
P1	/	/	35%	36%	53%	57%
P2		/	59%	20%	45%	80%
P3		/	35%	32%	27%	46%
P4		/	64%	40%	45%	67%
P5	/		52%	38%	64%	60%
P6	/	/	68%	50%	71%	80%
P7*	/		74%	91%	92%	92%

P8*	/		50%	65%	60%	62%
P9		/	55%	44%	63%	65%
P10	/	/	61%	65%	77%	86%

The two starred schools (P7 and P8) were selected on the basis of value-added analysis using pupil-matched data from Y3 (Standardized tests) to Y6 (NC data) The equivalent data to that used for other LEAs is shown in the table.

Selection of Secondary Schools

Two criteria were used:

A. Matched data from Key Stage 3 (95/96) to GCSE (97/98) was evaluated so that performance in Mathematics could be compared with overall school performance. The table below shows the difference expressed in terms of GCSE grades.

B Consistent improvement from 95/96 to 97/98 in Key Stage 3 Level 5+ attainment in Mathematics.

Table 2: The selection criteria for secondary schools

School	A	B	Mathematics □difference□	KS3 95/96	KS3 96/97	KS3 97/98
S1	/		0.28	40%	48%	50%
*S2				45%	46%	45%

			0.07*			
S3	/	/	0.20	28%	36%	44%
S4	/	/	0.22	30%	39%	42%
S5	/		0.18	62%	65%	66%
S6	/		0.17	67%	59%	63%
S7	/	/	0.42	59%	67%	72%
S8	/		0.21	58%	60%	62%
S9	/		0.28	74%	76%	63%
S10	/		0.16	45%	58%	54%

* All schools except for S2 show a GCSE grade advantage significant to 95% confidence limits.

The □Mathematics difference□ column shows the number of grades advantage at GCSE gained by a pupil in this school beyond that predicted by the value added data. With the exception of school S2, the differences are statistically significant (to 95% confidence limits). The position of school S2 is anomalous. In school S2, Mathematics GCSE performance is significantly better than pupils' overall GCSE mean score (a measure which was used in the early stages of the project prior to matching GCSE data with KS3 data).

The nature of the sample

It should be noted that the final selection of schools includes a wide range of contexts. There are primary and secondary schools from industrial, post-industrial, urban and rural contexts represented here.

Economically, they range from affluent professional suburban districts to some of the most socially deprived areas in Europe.

The Interviews

The selected schools were then visited by the researchers who conducted detailed, open ended, semi-structured interviews with the head teachers of the schools who were invited to identify the features of their schools of which they were most proud and any features which they felt might have contributed to their success. The interviews were wide ranging and although they all included a common core relating to management style, organization, ethos, policies, staff training and qualifications, resources, and parental involvement. However, head teachers were encouraged to lead the interview in the direction they felt was most significant. The interviews varied in length and character, but lasted at least an hour and sometimes as much as three hours.

Detailed, open ended, semi-structured interviews were also conducted with subject leaders (mathematics coordinator or head of department) in each school. Again, the interviews were wide ranging and the subject leader was encouraged to identify the features they felt were significant in their school, but a common core relating to management style, organization, ethos, policies, staff training and qualifications, implicit theories of teaching and learning, teaching styles, classroom organization, and numeracy was included in each case. These interviews lasted between one and two hours each.

In a further visit, the researchers then observed a sample of mathematics lessons (between 4 and 6) in each school. Classroom processes were analyzed and with the aim of validating aspects of

the interview data and interpreting some of the classroom processes described. Some excerpts of lessons were videotaped to provide stimulus material for discussion at a network meeting.

All interviews were audio-tape recorded and transcribed. Immediately following each visit for interview or lesson observation, the researchers sat in their car in a convenient lay-by and audiotape recorded a debriefing discussion to triangulate impressions and interpretations and provide a record of emergent theories and ongoing focussing questions.

An action research network group was then set up consisting of 5 primary mathematics coordinators and 5 secondary heads of department to validate the findings of the researchers, discuss classroom processes and develop recommendations on the nature of good practice in the teaching of numeracy.

Triangulation of data was provided by the range of respondents and the 2 researcher/observers. Data gathered from the head teacher was validated by comments made by subject coordinators, teachers and pupils. Teaching styles and strategies nominated by teachers and subject leaders were validated and interpreted through classroom observation and discussions with pupils.

Where observed behaviour in the classroom seemed in the opinion of the researchers to be at odds with approaches nominated by teachers or subject coordinators, follow up interviews were used to clarify the complex issues of style and strategy involved. Several of the teachers observed found it difficult to describe their approaches and beliefs in interview, seeming to lack an adequate language to do justice to the complexity of their skills and behaviours. In such cases, detailed discussions about the particular lesson observed after the event were used to clarify issues for the researchers.

An interim report was sent to all the schools involved for respondent validation purposes. A second draft

was then discussed in detail at a network meeting with representatives from a primary and secondary school in each LEA for further validation. A second phase of the project is planned to lead to more detailed advice and guidance being developed from further network meetings.

The results

In nearly every case, we considered that our observations confirmed the validity of the selection process through statistical analysis. We consider ourselves privileged to have visited so many exceptional schools which are making a significant and positive impact on mathematical attainment above and beyond the qualities of their incoming pupils, their families and even the social determinants of gender, class and race (Mortimore et al, 1994, p316).

The majority of schools showed aspects of the positive features we have identified at all levels in the institution- whole school, subject leader and classroom teacher. However, in the case of one secondary school we considered that an exceptional head of department was succeeding against the trend in an otherwise unexceptional school. In another secondary school we considered that an exceptional head had generated a very positive ethos which was driving an otherwise unexceptional mathematics department. In one primary school we considered that most of the features of good management which were common to the other institutions were missing and that the mathematics coordinator was making progress in spite of the head teacher. In two of these cases we considered that there was evidence to suggest that the baseline data was suspect, having been artificially depressed due to earlier contextual factors.

The key features which we have identified as representing □good practice□ were remarkably consistent from school to school and from phase to phase. We had anticipated originally that we would need to report separately for primary and secondary schools, but have been struck by the common characteristics of effective schooling at all ages and the comments which follow apply to all ages.

There is not room here to consider in detail all the features which were identified at each level. This paper will focus on those features dealing with the management of the subject within the school by the team leader or head of Deaprtment.

Common features of good practice identified at the level of the whole school

Ethos

In nearly all the schools visited the ethos of the school was judged to be a significant factor in accounting for its success. Team leaders and Heads of department reported consistently that they were proud of their staff, their hard work, dedication, and commitment to the school. In nearly all cases, the physical environment was very well cared for - sometimes in very difficult circumstances. Teachers talked about the messages sent to children by their environment. In most cases there were displays of pupils' work and achievements prominently placed around the buildings in public areas as well as in classrooms. The work displayed was generally recent, confirming teachers claims that it was changed regularly. In secondary schools, mathematics departments had tried to make their presence felt in an area of the school. Signs saying □Welcome to Mathematics□ were common.

There was a clear focus in all the schools on academic achievement and standards. In some cases this was a fairly recent and deliberate change - to become more □hard nosed□ about the purposes of school. In two secondary schools we saw detailed week by week curriculum planners on the wall showing how

the subject teaching would progress through key stage four up to the examination.

There was evidence from both teachers and pupils that teachers liked their pupils and knew and cared about them as individuals. There was a sense that all pupils were valued for themselves, not just the high achievers and that the school had a sense of community in which members were supposed to care for each other. Pupils□ opinions were listened to and taken seriously. This was sometimes evidenced in formal whole school structures through which pupils could express their views. For example, two secondary schools had school councils. More often, however, it was observed in pupils making extended verbal contributions to lessons and being listened to seriously by teachers and other pupils. When wrong answers were given there was no shame. □If you don□t get things wrong occasionally you never learn□.

In most, although not all cases, there was a sense in which it was □safe□ for pupils to make verbal contributions in class without fear of humiliation because of an expectation that the class and teacher would support tentative attempts to express ideas. For example, in one mixed age and ability Reception/Y1 group, the whole class waited in anticipation while a new child slowly matched 4 yellow teddies with the number 4, willing him on silently. On success, the class burst into spontaneous clapping and one girl interjected with obvious pleasure □He did really well didn□t he Miss, and he□s only just started!□. However, in one atypical secondary school where we considered the ethos to be a negative indicator, a teacher who had just encouraged a contribution from a pupil at the board said □I can□t do that as much as I□d like with my top set classes - they poke fun at each other at break if they make a mistake, so the weaker ones won□t try□. In the majority of successful schools in both primary and secondary phases community spirit and discipline combined to create a safe supportive environment for teaching and learning and pupils appeared willing to contribute.

Discipline

Most schools had assertive discipline policies which had been developed collaboratively by the staff rather than □bought in□ as a package. In most secondary schools the policy was the result of significant consultation and collaboration within working parties. In the majority of cases teachers expressed agreement with the school's discipline policy and claimed operate it consistently. Such policies included a clear structure of rewards and punishments and in most cases a system of positive and negative consequences was published in classrooms. Discipline was not usually an issue in the lessons we observed with most schools presenting pupils with an expectation of sociable behaviour. For example, in only two cases did we meet pupils who were less than polite on meeting visitors in the car park, and it was not unusual to be asked □Can I help you?□ by a passing pupil. In most successful schools we were struck by the polite and helpful behaviour of the pupils. It should be noted that the schools were not all in the □leafy suburbs□ and the comments apply to some schools in areas of high social deprivation.

Management of staff

In nearly all the schools visited, the professional skills of teachers were respected, responsibility was delegated and initiative encouraged. Management styles were generally corporate or collegial rather than autocratic and there was an emphasis on collaborative planning at all levels. In the majority of cases interviews with teachers indicated that there was a sense of shared ownership of policies and a sense of common purpose.

In nearly all schools, effective use was made of middle managers to whom significant responsibility had been delegated. Middle managers such as subject coordinators or heads of department were given □

freedom within fences□. That is to say clear aims and guidelines were agreed, but within those guidelines middle managers operated with significant autonomy. For example one secondary Head of Department said □I used to have to go running to the last head over every little thing, but this head is great - he trusts me.□

In most cases, the □Casablanca model□ of curriculum planning operated - clear aims, clear frameworks, a □hands off□ attitude to those with devolved responsibilities but close monitoring of ongoing teaching and learning, and detailed monitoring of trends in final outcomes of learning. For example, one primary head (who had previously been a mathematics coordinator herself) said □I can□t be an expert in everything, even in a subject as important as mathematics, so I have to trust and support the experts I have appointed.□ However, heads who did this monitored systematically and held staff accountable for their results.

In the most successful schools the head was aware of and able to discuss in detail the policies and practices in mathematics, indicating a good awareness of issues of current concern during their interview, but made a point of giving their coordinator or head of department space to talk for themselves in later interviews.

In most schools managerial structures existed to make teachers accountable for learning outcomes at all levels. Systematic testing and target setting was often used in intermediate years, not just the end of a Key Stage. For example, most primary schools had introduced testing and were introducing target setting in years 3, 4 and 5. □There is no place to hide anymore. It isn□t just the responsibility of the Y6 teacher to meet our targets - we all have a part to play.□

In the most successful primary and secondary schools the head, senior managers and subject leaders were involved in systematic monitoring of pupils' work, the marking of books, and the setting of homework. For example using stickers or stamps in pupils□ books saying: □The head has seen this book □.

Heads claimed that they were trying to place emphasis on teaching and learning rather than administration. Pedagogy was placed high on the agenda of staff/departmental meetings rather than administration. For example, in one primary school, the short Monday meeting was designated the administration meeting and the longer midweek meeting the teaching meeting at which teaching issues were shared and discussed. One secondary school head monitored departmental meeting minutes and demanded that pedagogy always appear as an item.

Successful schools were □data rich□. Head teachers and middle managers monitored learning outcomes monitored early enough to allow intervention and recovery from poor performance, for example one secondary school gave □mock examinations□ in Y10.

Statistical data was used carefully, but openly to raise staff expectations of pupils' potential, often being presented in a digested form to focus attention on key features and be easily usable by staff. Effective head teachers used data about similar schools from league tables to challenge complacency and low prior expectations. They focussed attention on significant improved performances to stimulate competitiveness, professional pride and the sharing of good practice.

Data was used sensitively but directly to clearly identify problem areas to those involved, for example one secondary head used value added data to demonstrate under-performance clearly to departments and

teachers directly so as to begin planning for change. Although heads worked in a collegial manner, they had what one referred to as □the edge□ and □placed children's welfare and achievement ahead of teachers' egos□.

In the many cases, value added analyses made examination based assessments of teaching quality more acceptable to teachers allowing heads to hold staff accountable for learning outcomes and to set challenging targets. In such cases the role of the head of department or subject leader was pivotal in negotiating between subject staff and senior managers, targets which were both credible and challenging. The key to this negotiation was data which indicated expectations at pupil level which could be used as to focus attentionon the individual pupils who would have to meet their own individual targets if deparmental and hence school targets were to be achieved. In the best cases, the target setting process involved open communication and negotiation, supported by accurate data, from the level of pupil, through class and department up to whole school and back down to individual pupil.

Common features of good practice identified at the level of the subject leader

(Mathematics Coordinator or Head of Department)

Subject leaders

The most effective subject leaders had been empowered to do the job and were supported by their line managers. They operated within the guidelines negotiated with their heads, but within those guidelines they had the freedom to exercise their own professional responsibility.

They aimed to be the lead professionals in their subject, recognised for the high standard of their teaching skills. They were not necessarily *the* best, but certainly *one of the best* teachers in their subject. In primary schools, their background had not necessarily been very mathematical. In most cases their highest qualification in mathematics had been GCSE when they first took on the role. However, they had all developed their skills in the subject through further courses. For example, two had followed diploma courses in a local college.. They all had personal qualities which made them approachable, and often claimed that their initial difficulties with the subject helped them to understand the difficulties of others. Their role as □lead professional□ was not based on their knowledge of mathematics, although they all appeared confident and secure in their subject knowledge at KS2, but rather on their knowledge of mathematical pedagogy and in this they aimed to be expert.

Teamwork

Standards of mathematics are highest when the teachers operate as a team. As one secondary head put it - □my maths department aren□t the very best teachers in the school as individuals, but they are by far the best team - and the whole is far greater than the sum of the parts□.

The most effective teams shared common aims and values - generally the result of effective team leadership rather than serendipity. Such teams trust each other sufficiently to be prepared to act as critical friends when discussing pedagogy. The most effective teams were reflective and self monitoring and were described as such by their heads.

Team leaders led from the front - □I wouldn□t ask any of my team to do anything I couldn□t do myself□ said one secondary head of department when explaining why she would be the first to be videotaped for

staff development purposes. They were team builders, working to develop common aims and values and stimulate change through persuasion rather than dictation, aiming for □hearts and minds□ rather than compliance. However, they also had a sense of drive and purpose and were willing to challenge complacencies to encourage the development of higher expectations. For example, some had used statistical data effectively to compare their performance with similar schools or other departments to demonstrate under performance and the need for change.

Delegation

One of the ways in which team leaders developed team spirit, especially in secondary schools was via effective delegation. In most of the secondary schools Heads of Department had delegated appropriate responsibility for aspects of their work to each of the members of the team. Even in the case of newly qualified teachers, an expectation existed that the teacher would take on a small but significant task which required management and leadership. For example, a newly qualified teacher might be given responsibility for managing the department□s entries into a National mathematics competition, whilst a more experience member of the team might be responsible for developing curriculum materials in year 8. Each team member required the cooperation of their colleagues in order to successfully manage their own area.

The Casablanca model (Holt,1996) was followed here too, in that tasks which had been delegated in this way were under the complete control of the teacher concerned. Good managers monitored progress, but avoided interference.

Encouraging change

Several team leaders had used the introduction of a new resource or participation in a curriculum development project as a vehicle to encourage monitoring, reflection and pedagogical change. One secondary head of department when referring to the resources provided by a project said □The materials aren□t that good, but I wanted us all to sit down and talk about how we□d use them in the classroom□.

They ensured that pedagogical questions were discussed on a regular basis at meetings, either as the main item on the agenda of departmental meetings or in designated staff meetings. On such occasions, team members were often encouraged to take the lead and describe and reflect on an aspect of their teaching. Effective team leaders often focussed attention on effective performance, eg: an improving class or a teacher□s new successful approach or developments within another department or school.

Effective subject leaders ensured that a framework existed within which their team members were able to operate professionally and responsibly. Schemes of work for mathematics structured the progression of teaching and learning experiences, but were flexible enough to allow professional judgements to be made and to accommodate individual styles. Schemes of work offered guidance on sources of support materials, possible teaching approaches and assessment opportunities. Investigative approaches and problem solving activities were integrated into the curriculum and used at appropriate points in lessons as a matter of policy.

Published texts and schemes were used only as a resource, to be selected from when necessary to support teachers□ objectives - the teachers drives the curriculum not the scheme. A variety of such resources was available and was supplemented by teachers□ own materials. In fact there was often an emphasis is on teachers developing and selecting their own materials and sharing them with others.

Monitoring

Effective subject leaders follow the Casablanca model (Holt,1996) of management in that they encourage professional judgement and discretion but progress monitored closely so that they can act quickly when necessary. Pupils learning and teachers assessment was monitored through the regular and systematic sampling of books (equivalent to Jack Warner watching the rushes). Planning was monitored through the collection of weekly planning sheets (primary) or forecast and record books (secondary). Teaching and learning was further monitored through regular and systematic lesson observation.

Such observations were intended to be collegial and non-threatening to the observed teacher, but were intended to be evaluative and professionally useful. Some schools used peer evaluation and support effectively to foster collegiality and reflection. Several subject leaders encouraged their team to observe them teaching and offered to act as in-class support when possible to encourage curriculum development. Several expressed the view that the introduction of performance related pay would sour such collegial staff development.

Planning

In nearly all schools we observed detailed planning, both of the overall scheme of work and of individual lessons. Most of the lessons which we observed exhibited clear learning objectives, an obvious overall structure structure, and a variety of learning activities. Nearly all the teachers planned to end their lessons with plenaries and noted possible assessment opportunities (cf Reynolds, 1998). Unfortunately, plenaries did not always occur as planned and several teachers talked about the plenary they had intended to have if only the bell had not rung. The majority of the lessons did end in some form plenary however, and in the best cases we considered the plenary to have contributed significantly to learning.

Conclusion

The strategies and approaches which we observed in the schools which were identified as particularly successful in value-added terms and have recommended as good practice are in line with research elsewhere (eg: Ayers et al, 1999; Cobb et al, 1997, Tanner & Jones, 1999). In particular, they further validate some of the approaches suggested by the National Numeracy Project (Straker, 1997). However, it is clear that even teachers in some of the most successful schools had received very little training on how to cope with their responsibilities as middle managers. Although they had often proved themselves to be good teachers or mathematicians, their management role was often left to chance. The key elements of their approaches identified here are unfortunately not common to all schools. Communicating those approaches to teachers in other schools is going to be a difficult task. However, the progress demonstrated by these successful schools dictates that we must.

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